

**Internal distribution code:**

- (A) [ ] Publication in OJ  
(B) [ ] To Chairmen and Members  
(C) [ ] To Chairmen  
(D) [X] No distribution

**Datasheet for the decision  
of 18 June 2009**

**Case Number:** T 0250/07 - 3.3.03

**Application Number:** 95925596.9

**Publication Number:** 0770098

**IPC:** C08F 8/32

**Language of the proceedings:** EN

**Title of invention:**

Dispersants based on succinimide additives derived from heavy polyamine used for lubricating oil

**Patentee:**

ExxonMobil Chemical Patents Inc.

**Opponent:**

The Lubrizol Corporation

**Headword:**

-

**Relevant legal provisions:**

EPC Art. 54, 56

**Relevant legal provisions (EPC 1973):**

-

**Keyword:**

"Novelty - yes"  
"Inventive step - yes"

**Decisions cited:**

T 0039/02

**Catchword:**

-



**Case Number:** T 0250/07 - 3.3.03

**DECISION**  
**of the Technical Board of Appeal 3.3.03**  
**of 18 June 2009**

(Opponent)

The Lubrizol Corporation  
29400 Lakeland Boulevard  
Wickliffe  
Ohio 44092 (US)

**Representative:**

Crisp, David Norman  
D Young & Co  
120 Holborn  
London EC1N 2DY (GB)

**Respondent:**

(Patent Proprietor)

ExxonMobil Chemical Patents Inc.  
1900 East Linden Avenue  
P.O. Box 710  
Linden  
NJ 07036-0710 (US)

**Representative:**

UEXKÜLL & STOLBERG  
Patentanwälte  
Beselerstrasse 4  
D-22607 Hamburg (DE)

**Decision under appeal:**

Interlocutory decision of the Opposition  
Division of the European Patent Office dated  
27 September 2006 and posted 4 December 2006  
concerning maintenance of European patent  
No. 0770098 in amended form.

**Composition of the Board:**

**Chairman:** R. Young  
**Members:** M. C. Gordon  
C. Vallet

## Summary of Facts and Submissions

- I. Mention of the grant of European Patent No. 0 770 098 with the title "Dispersants Based On Succinimide Additives Derived From Heavy Polyamine Used For Lubricating Oil" in the name of Exxon Chemical Patents Inc., later ExxonMobil Chemical Patents Inc. in respect of European patent application No. 95925596.9, filed on 11 July 1995 as international application No. PCT/US95/08623, published as WO-A1-96/01854 on 25 January 1996, and claiming a priority date of 11 July 1994 from US 273,294 was announced on 11 November 1998 (Bulletin 1998/46) on the basis of 18 claims.

Independent claims 1 and 11 read as follows:

"1. An oil soluble imidised additive comprising the reaction product of a functionalised hydrocarbon and a heavy polyamine, wherein said heavy polyamine has an average of at least 7 nitrogens per molecule and an equivalent weight of 120-160 grams per equivalent of primary amine."

"11. A process for producing an imidised additive comprising the steps of

a) functionalising by halogenating, ene reacting, or free radical grafting a backbone selected from the group consisting of hydrocarbon, polymer, and polybutene with a carboxylic acid or anhydride agent; and

b) then reacting said backbone with a heavy polyamine, wherein said heavy polyamine has an average of at least 7 nitrogens per molecule and equivalent weight of 120-160 grams per equivalent of primary amine."

Claims 2-10 and 12-17 were dependent claims whereby claim 2 specified that the hydrocarbon was a polymer.

Claim 18 was directed to the use of the additive of claim 2 and read as follows:

"18. The use of the additive of claim 2 wherein said polymer has number average molecular weight of 450, as an additive in a two-cycle engine oil."

II. A notice of opposition to the patent was filed on 10 August 1999 by The Lubrizol Corporation. The grounds of opposition pursuant to Art. 100(a) EPC (lack of novelty, lack of inventive step) and Art. 100(c) EPC (extension of the subject-matter of the patent beyond the content of the application as filed) were invoked. The following documents were cited in support of the opposition:

D1: US-A-3 259 578

D2: US-A-4 234 435

D3: US-A-5 053 152.

Together with a letter dated 30 August 2001 the opponent submitted an experimental report ("Annex A") relating to a repetition of example I of D3.

III. By a decision announced orally on 12 September 2001 and issued in writing on 6 November 2001 the patent was revoked.

The patent proprietor appealed against this decision.

In decision T 39/02 of 17 December 2003 (not published in the OJ EPO) the Board of Appeal set the decision of the opposition division aside and remitted the case to

the opposition division for further prosecution on the basis of the second auxiliary request.

- (a) This request consisted of claims 1-17 of a set of 18 claims, designated "Set A'", filed with a submission dated 28 August 2001, and amended by deletion of claim 18 thereof (letter of 12 March 2002, i.e. the Statement of Grounds of Appeal in case T 39/02).

The appellant stated in this connection that use claim 18 of the patent as granted would no longer be defended (see section I, above).

Claim 1 of claim set A' read as follows, additions compared to claim 1 of the patent as granted being indicated in **bold**:

"1. An oil soluble imidised additive comprising the reaction product of a functionalised hydrocarbon and a heavy polyamine, wherein said heavy polyamine **is a mixture of higher oligomers of polyalkylene amines and** has an average of at least 7 nitrogens per molecule and an equivalent weight of 120-160 grams per equivalent of primary amine."

The definition of the heavy polyamine in part b) of Claim 11 had been amended identically.

Claims 2-10 and 12-17 were identical to those of the patent as granted.

- (b) With respect to Art. 84 EPC it was held in T 39/02 (part 5 of the reasons) that the term "higher oligomers" was sufficiently elucidated by the ensuing characterisation, i.e. "and has an average

of at least 7 nitrogens per molecule and an equivalent weight of 120-160 grams per equivalent of primary amine".

Furthermore the skilled person was aware from its common general knowledge that oligomers, as opposed to polymers, comprised relatively low numbers of repeating units (e.g. with a maximum around 10) and thus was in no doubt about the practical significance of this term, especially if account was taken of the disclosure of the patent specification, reference being made to page 3, lines 27 to 52.

Accordingly the requirements of Art. 84 EPC were met.

(c) The claims were also held to meet the requirements of Art. 123(2) and (3) EPC.

(d) The subject matter of claim 1 was also novel with respect to the disclosures of D1 and D2 (T 39/02, reasons 8).

Whilst it was evident from the methods for the preparation of the polyamines referred to in D1 and D2 that these documents *inter alia* envisaged the use of polyamine mixtures, these documents were devoid of any disclosure attributing to these mixtures an average of at least 7 nitrogens per molecule and an equivalent weight of 120-160 grams per equivalent of primary amine.

In this connection it had also been held in section 3.4 of the reasons of T 39/02 that the disclosure of specific compounds in D1 and D2, in particular of a compound designated "Polyamine N-

400" could only be interpreted to relate to a polyamine compound having precisely the indicated structure, i.e. a compound having 10 nitrogens and an equivalent weight of about 135 grams per equivalent of primary amine.

(e) With regard to D3 and the experimental report "Annex A" the Board noted in part 9 of the reasons of T 39/02 that:

- D3 had not been taken into account in the decision under appeal;
- its relevance in the appeal proceedings as well as that of Annex A had been mentioned only about one month prior to the oral proceedings before the Board;
- no written submissions by the appellant with regard to Annex A had been available at the oral proceedings;
- a decision concerning the relevance or possible novelty destroying character of D3 could not have been arrived at without having given sufficient opportunity for the Appellant to reply and/or provide counterevidence;
- the appellant had requested that D3 should not be considered in the oral proceedings before the Board.

Accordingly it was decided not to include a consideration of D3 at the oral proceedings.

(f) It was further noted that it appeared that upon remittal the first step should be to invite the appellant/patent proprietor to present submissions with respect to Annex A.

IV. In a second decision announced orally on 27 September 2006 and issued in writing on 4 December 2006 the opposition division held that the patent could be maintained in amended form on the basis of the aforementioned claim set A' (claims 1-17) which constituted the main request.

- (a) With regard to Art. 54 EPC and D3, the decision held that although Example I thereof had been reworked by the opponent, in the experimental evidence (i.e. "Annex A") there was no indication that in D3 products were obtained as defined by claim 1 of the main request. The product of example I of D3 - derived from tetraethylene pentamine ("TEPA") and tris(hydroxymethyl) amino methane ("THAM") - was a condensation product which, according to the last paragraph of column 1 in D3 was a high molecular weight extended polyamine.
- Therefore, unlike oligomers of polyalkylene amines, the extended polyamine condensation product was not based on repeat units in the sense of the patent in suit. Only TEPA was used as the oligomer of polyalkylene amine in D3. THAM was not an oligomer. D3 did not explicitly disclose a **mixture of higher oligomers of polyalkylene amines** as being the starting material (emphasis of the decision under appeal).
- The Opponents' interpretation that a mixture of various condensation products of TEPA and THAM had to be considered as a **mixture of higher oligomers of polyalkylene amines** was in contradiction to the definition given in the description of the patent



in suit (emphasis of the decision under appeal). Specifically, TEPA contained only four units (i.e. 5 N atoms) and the condensation with THAM did not increase the amount of said units.

Even if it were assumed that TEPA was a mixture of oligomers there would be no indication that it contained oligomers having at least 7 N atoms per molecule.

With regard to the acylation product it could be seen from D1 (column 3, lines 64ff) that the nature thereof depended on the reaction conditions. The conditions were not the same in D3 and in the examples of the patent in suit. In view of this it was unclear which product had actually been obtained according to D3.

Although the opponents had reworked example I of D3 neither experimental evidence nor the spectra or chromatograms had been provided. Hence neither the patent proprietor nor the opposition division were in a position to verify the results obtained.

- (b) With regard to Art. 56 EPC by common consent D1 or similarly D2 represented the closest prior art since it related to mineral lubricating oil composition. The composition comprised oil and a compound based on branched polyalkylene polyamine which could be acylated with alkenyl succinic acid or anhydride.

"Polyamine N-400" was disclosed in D1. Further D1 disclosed the functionalisation of an olefin with maleic anhydride which was reacted with a polyalkylene polyamine.

In view of D1 the objective problem to be solved was the provision of an additive suitable as a

lubricant; the additive imparting improved sludge dispersing properties, reference being made to the examples and comparative examples of the patent in suit.

D1 was directed to solving the problem of frictional forces. However D1 did not hint or suggest a mixture of higher oligomers of polyalkylene amines since, as ruled in T 39/02 "Polyamine N-400" was disclosed only as a single compound and not as a mixture.

Examples 3 and 4 of the patent clearly showed that the inventive examples, employing a product designated "HA-2" as the heavy polyamine resulted in better values of the Sludge Inhibition Bench Test (SIB) than examples which did not contain such an additive.

Although D2 disclosed mixtures of alkylene polyamines there was no disclosure of the composition of these mixtures. In particular D2 did not disclose whether or not such mixtures were mixtures of higher oligomers as defined in claim 1 of the patent in suit.

Consequently, neither D1 and/or D2 alone or in combination with D3 hinted or suggested the presence of a **mixture of higher oligomers of polyalkylene amines** as solving the indicated problem (emphasis of the decision).

D3 alone could not suggest the claimed subject matter, reference being made to the above discussion concluding that the nature of the products thereof was unclear.

(c) Accordingly the patent could be maintained in amended form on the basis of claims 1-17 of claim set A'.

V. A notice of appeal against this decision was filed by the opponent on 13 February 2007, the prescribed fee being paid on the same day.

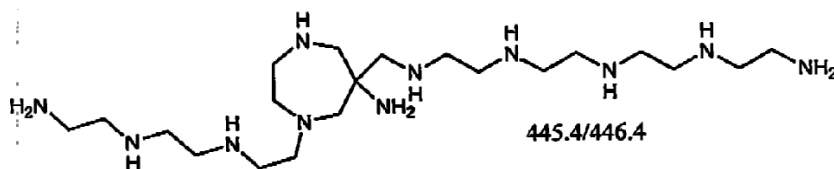
VI. The statement of grounds of appeal was filed on 13 April 2007.

The statement of grounds of appeal was accompanied by 28 annexes - designated B-Z and AA, BB and CC relating to repetitions of the teachings of D3 and the structures of the resulting products.

(a) With respect to novelty it was submitted that the inevitable result of carrying out the teachings of D3 was a heavy polyamine having the features of operative claims 1 to 8 and 14 to 17. Reference was made to example I in combination with example D and example IV in combination with example C of D3 and to the experimental evidence advanced.

In particular it was submitted, that the experimental evidence of "Annex A" demonstrated that the inevitable result of carrying out the condensation reaction of Example I of D3 was a heavy polyamine having all the features of operative claim 1.

A number of structures as representative examples of those which result from the process of Example I of D3 were presented, *inter alia*:



It was submitted that the further experimental evidence confirmed that in the case of examples I and IV of D3 products were obtained having the primary amine equivalent weight as defined in the operative claims.

Accordingly the inevitable result of carrying out the teachings of D3 was a product as defined in the operative claims.

- (b) With regard to inventive step and specifically, with regard to D3 as the closest prior art it was submitted that D3 related to the same problem as the patent in suit, i.e. a dispersant which contained a low free amine content. D3 also taught the solution to this problem, namely that higher molecular weight polyamines, i.e. extended or condensed polyamines, had better performance with a lower free amine content.

It was well known at the date of the patent to react functionalised hydrocarbons with polyamines to produce dispersants. It appeared from the patent that the alleged invention was merely based on the commercial availability of the new polyamine "HA-2". Taking newly available polyamine and using it to form a dispersant was an obvious step to take and no surprising effect resulted. The conclusions of the opposition division that the nature of the products in D3 was unclear was incorrect, reference being made to the arguments advanced with respect to novelty (see section (a), above). Further D3 clearly taught that moving to heavier polyamines would result in better engine performance. In view of this teaching the use of

"HA-2" would have been an obvious thing to try and D3 taught that it would give good results, i.e. there was a reasonable expectation of success.

- (c) With regard to the combination of D2 and D3 it was submitted that D2 showed that dispersants made with polyamines were very well known in the art - as had been admitted by the patent proprietor. Polyamines were extensively described in D2. Their use to form dispersants was common general knowledge and was in fact the major use of polyamines.

It was further known from D2 that polyamines were useful and from D3 that higher amines would give good results. Hence the use of a higher amine such as "HA-2" would have been completely obvious to a skilled worker.

- (d) With regard to D1 or D2 as the closest prior art it was submitted that these contained similar disclosures with respect to "Polyamine N-400". D2, for example disclosed polyisobutenyl succinic anhydride ("PIBSA") type dispersants where the PIBSA could be reacted with a polyamine, "Polyamine N-400" being exemplified, which polyamine met the requirements for N-atom content and equivalent weight of operative claim 1. Although it had been decided in T 39/02 that "Polyamine N-400" was a pure compound rather than a mixture, the skilled person would nevertheless consider that the preparation of a polyamine mixture as required by the patent lacked an inventive step in view of the disclosures in D1 and D2, since, *inter alia*:

- it was common general knowledge that these polyamines could be prepared as mixtures;
- the process described in D1, referred to in D2, resulted in a mixture; and
- in D2 there was a reference to commercial mixtures of ethylene polyamines.

Thus both D1 and D2 taught that mixtures could be used.

Further nothing inventive could be perceived in using a mixture which averaged to the polyamines disclosed in D1 and D2.

The data in the patent could not support an inventive step since it was not comparative data based on the closest prior art D1 or D2.

- (e) The appellant/opponent observed that the opposition division had based its decision in respect of inventive step on the disclosures of D1-D3 whereas at the oral proceedings the opponent had only been permitted to make submissions with respect to D1. The fact that the decision had been based on arguments which the opponent had not been allowed to present during oral proceedings was considered to represent a substantial procedural violation.

VII. The patent proprietor - now the respondent replied in a letter dated 29 October 2007.

- (a) It was objected that the objection of lack of novelty with respect to example D and with respect to example C with example IV of D3 were late filed, not having been advanced in the notice of opposition but only subsequently.

Accordingly it was requested that the Board decide whether the late filed pieces of evidence, in particular annexes M to Z and AA, BB and CC could be admitted to the proceedings.

- (b) With regard to novelty the respondent referred to the construction of the claims as ruled in T 39/02 (see section III(b), above).

In particular it was emphasised that the higher oligomers of polyalkylene amines were molecules which consisted of repeating alkylene amine units. It was submitted that D3 disclosed a high molecular weight N-containing condensate, also referred to as "extended polyamine". Regarding examples I and IV relating to condensation products of THAM and TEPA it was submitted that according to the appellant/opponent's own submissions this condensation product was not a mixture of higher oligomers of polyalkylene amines. The structures shown in the statement of grounds of appeal (one example of which is provided in section VI(a), above) were condensation products each of which compounds contained at least one structural unit derived from THAM. Thus these compounds were not higher oligomers of polyalkylene amines in the sense of the patent in suit. Their structure did not consist only of repeating units of ethylene amine but in addition contained one or more units derived from THAM.

- (c) Regarding inventive step it was submitted that an attack based on D3 alone failed for reasons similar to those presented with respect to novelty, specifically that the disclosure in D3 of N-

containing condensates and the reaction product of such condensates did not render obvious the claimed imidised additive which was the reaction product of the specified mixture of higher oligomers of polyalkylene amines having defined properties (cf operative claim 1).

The combination of D2 and D3 suggested by the appellant/opponent was submitted to be based on hindsight. In the absence of knowledge of the patent in suit it was unclear what the result of the combined consideration of D2 and D3 would be and the appellant/opponent had failed to explain how the skilled person on the basis of the disclosures of D2 and D3 would arrive at the claimed subject matter.

Regarding the combination of D1 and D2 it was submitted that the findings of T 39/02 (see section III, above) were relevant not only for novelty but also for inventive step.

In this connection it was submitted that the opponent had failed to explain on which basis the skilled person would arrive at the use of a heavy polyamine which was a mixture of higher oligomers of polyalkylene amines as specified in operative claim 1.

VIII. On 26 March 2009 the Board issued a summons to attend oral proceedings.

IX. In a letter dated 18 May 2009 the appellant/opponent submitted as Annexes DD and EE further experimental data.



X. In a letter dated 15 June 2009 - 3 days before the oral proceedings - the appellant/opponent submitted a further document:

D4: US-A-5 277 833,

a document referred to in the patent in suit.

XI. Oral proceedings were held before the Board on 18 June 2009.

During the course of the oral proceedings the appellant withdrew the request for D4 to be admitted to the proceedings (see section X, above).

(a) With regard to the question of novelty with respect to the disclosure of D3 the appellant/opponent submitted that operative claim 1 was a product by process claim. The reaction product of D3 was a mixture of species. All the OH groups of THAM were consumed, and the resulting product had on average at least 7 nitrogen groups per molecule and an equivalent weight of primary amine within the range specified. Further the molecule contained polyalkylene amine components, regardless of the fact that it also had some branched and/or cyclic components - these were not excluded by operative claim 1. Hence once the THAM/TEPA reaction product of D3 had been reacted with the functional carboxyl compound the product was identical, regardless of what the starting material was, and even if the starting material was not strictly an oligomer.

The respondent/patent proprietor submitted that the language of the claims, i.e. "a mixture of higher oligomers of polyalkylene amines" was unambiguous. An oligomer consisted of repeating

units from the same monomer but was not the reaction product of two types of monomers or a condensate as described in D3 (cf discussion of the meaning of the term "oligomer" in the decision under appeal reported in section IV(a), above and the submission of the respondent/patent proprietor reported in section VII(b), above). All of the structures presented by the appellant/opponent in the statement of grounds of appeal as potentially arising from the reaction in D3 (cf the exemplary structure reported in section VI(a), above) were distinguishable from oligomers as none of these had repeating units derived from polyalkylene amines. Instead these structures exhibited THAM derived units which could not be obtained by oligomerisation of polyalkylene amines.

The appellant/opponent emphasised that the product in D3 had repeating units of polyalkylene amines and that there was no requirement in the claim that there be repeating units of the same monomer throughout the molecule.

The Board drew attention to the wording of the claim, i.e. "**a mixture of** higher oligomers **of...**" and distinguished this from a formulation such as "**containing** units derived **from...**".

Following a break for deliberation the Board announced its decision that the term "oligomers of polyalkylene amines" had to be interpreted as meaning a product resulting from an oligomerisation reaction of a polyalkylene amine and which contained repeating units of that polyalkylene amine.

The appellant stated that it did not wish to make any further submissions with respect to novelty.

- (b) With regard to inventive step, the appellant/opponent stated that it would not refer to the experimental data (Annexes A-Z, AA, BB, CC, DD and EE).
- It was submitted that D2 could be taken as representing the closest prior art, the disclosure of D1 being essentially the same.
- D2 related to the same technical field as the patent in suit, reference being made to the paragraph bridging columns 44-45 of D2.
- The compound "Polyamine N-400", disclosed at column 25 lines 24-40 of D2 had 10 N atoms and an equivalent weight per primary amine group of 135, i.e. within the range specified in operative claim 1. The distinguishing feature of the claimed subject matter with respect to D2 was the use of a mixture of polyamines. No advantage had been shown for the use of a mixture compared to the pure compound. The data in the patent did not relate to the teaching of D2 and hence did not represent a comparison with the closest prior art. Thus the objective technical problem was to provide an alternative to the teaching of D2. The core of the invention was set out at page 9, lines 8 to 20 of the patent where it was stated that as the molecular weight of the dispersant backbone increased the polar segment limited the dispersibility. The technical solution set out in the patent in suit had already been provided by the use of a pure product in D2. Further D2 taught that mixtures could be used. Even though the composition of such mixtures was not given this statement showed that the inventors of D2 did not

consider that there would be any problem with using mixtures.

The patent in suit itself acknowledged that the polyamine "HA-2" was commercially available. Thus the invention amounted to nothing more than taking the teaching of D2 and using a commercial amine mixture the properties of which averaged out to those in the claim. This was the commercially most sensible approach.

The respondent/patent proprietor recalled the findings of T 39/02, in particular that the disclosure of mixtures in D1 and D2 did not attribute to these the features of operative claim 1 (see section III(d), above). The argument of the appellant/opponent applying the teachings relating to pure compounds in D2 to mixtures was in contradiction to the findings of T 39/02. It was instead necessary to look at the two disclosures of D2 separately, i.e. on the one hand the disclosure of a pure compound having the required features and also to consider mixtures. With respect to the disclosure in D2 of a pure compound the technical problem was to provide an alternative, i.e. a compound which was cheaper but which still exhibited comparable dispersant properties. The solution was not to replace the single compound with a conventional polyamine mixture since this would introduce low end materials which would have a detrimental effect as disclosed in the patent. Instead the solution was to use heavy polyamines. The patent explained why this was advantageous. It was further submitted that the argument of the appellant, i.e. replacing a single compound with a mixture averaging to the

same properties was based on hindsight. Reference in this respect was also made to the findings of T 39/02 (see section III(d), above). Further as regards the disclosure of pure compounds in D2 no emphasis was placed on the equivalent weight of primary amine.

The respondent/patent proprietor also recalled that the operative claims require that the product is an imidised additive. According to D2, col. 27 line 51ff a number of different products could arise - not only imides. These were disclosed as alternatives, a further alternative being mixtures of these. The restriction to imidised derivatives represented a further selection with respect to the disclosure of D2. It was emphasised that the reaction conditions had to be selected in order to ensure that imides were produced.

The appellant/opponent noted in this respect that the claims did not exclude the presence of other compounds in addition to imides. Further according to the patent, page 9 lines 46 and 47 the reaction conditions were selected preferably to favour the formation of imides or mixtures of imides and amides. Further no advantage had been shown to result from the use of specifically imides as opposed to other possible reaction products.

- XII. The appellant (opponent) requested that the decision under appeal be set aside and that the European Patent No. 770 098 be revoked.

The respondent (patent proprietor) requested that the appeal be dismissed.

## Reasons for the Decision

1. The appeal is admissible.
2. *Art. 54 EPC*
  - 2.1 According to the decision T 39/02 the subject matter of the operative claims is novel with respect to the disclosures of D1 and D2 (see section III(d), above).
  - 2.2 It remains to be decided whether the subject matter is novel with respect to the disclosure of D3.

It is recalled that according to section 5.2 of the Reasons of T 39/02 oligomers, as opposed to polymers comprise relatively low numbers of repeating units, e.g. a maximum around 10 (see section III(d), above). In other words, oligomers are polymers with a low degree of polymerisation.

A polymer is formed of "repeating units", i.e. identical units that become linked to each other - "polymerised" - to form a large molecule containing a plurality of said linked repeating units.
  - 2.3 D3 relates according to col. 1, lines 12-20 and col. 11 lines 61ff to a condensation reaction, the product of which is also referred to as an "extended polyamine" (col. 1 line 62). One of the compounds employed, namely TEPA is itself an oligomer in that it consists of four ethylene amine units joined together with a primary amine group at each terminus. This oligomer however does not satisfy the requirements of operative claim 1 since the number of nitrogen atoms (5) and the

equivalent weight per primary amine (94.5) are too low. The reaction of TEPA with THAM results in a condensation product in which the TEPA units are linked not to other TEPA units but to the THAM moiety with displacement of water (cf the structure reported in section VI(a), above). The fact that the TEPA units do not become linked to each other demonstrates that polymerisation of TEPA units does not occur and hence the resulting products are not polymers (oligomers). Thus although among the structures potentially resulting from the condensation reaction are some which contain a plurality of units derived from TEPA these structures are the result not of a polymerisation or oligomerisation reaction but of (a) condensation reaction(s), with the units derived from TEPA being linked directly to (a) residue(s) derived from THAM but not directly to other TEPA units.

- 2.4 Accordingly D3 does not disclose "oligomers of polyalkylene amines" of any kind and hence does not anticipate the subject matter of claim 1 of the sole request. This conclusion applies also to the subject matter of claim 11.
- 2.5 The operative claims therefore meet the requirements of Art. 54 EPC.
3. *Art. 56 EPC*
- 3.1 *The patent in suit*

According to the section "Field of the Invention" the patent in suit relates to additives for lubricants. It is explained that the use of functionalised

hydrocarbons or polymers reacted with heavy polyamines allows for incorporation of greater amounts of nitrogen into the dispersant molecule than prior art amines, thus resulting in superior sludge dispersancy properties.

According to the discussion in the section "Summary of the Invention" starting at page 3, line 9 commercial polyamines, "PAM" are known. Typical commercial PAM is a mixture of ethylene amines wherein the major part is formed of the aforementioned TEPA (5 nitrogens per molecule) and pentaethylene hexamine ("PEHA") (6 nitrogens per molecule). These commercial PAMs have an equivalent weight of 112-115 grams/equivalent primary amine and with a total nitrogen content of 33-34 wt% (page 3 lines 32-39).

According to page 3 line 40 of the patent in suit it has been discovered that heavier cuts of PAM oligomers with practically no pentamine oligomers (TEPA) and only very small amounts of hexamine oligomers (PEHA), but containing primarily oligomers with more than 7 nitrogens and more extensive branching produce dispersants with improved dispersancy compared to dispersants derived from the regular commercial PAM under similar conditions with the same polymer backbones. An example of such a heavier polyamine is the product "HA-2" which according to the discussion at page 3 line 45ff of the patent in suit is prepared by distilling out the lower boiling polyethylene amine oligomers including TEPA, resulting in less than 1 wt% TEPA. Only a small amount of PEHA (less than 25 wt%, typically 5-15 wt%) remains in the mixture. The balance is higher nitrogen content oligomers usually with a greater degree of branching. Analysis of this polyamine shows, according to the discussion at page 3, lines 49-



52 of the patent, a primary amine equivalent weight of 128 g/equivalent and a nitrogen content of 32-33 wt% (compared to 33-34 wt% for commercial PAM).

The examples and comparative examples show succinimide dispersant additives produced by derivatization of polyamines with polyisobutenyl succinic anhydride ("PIBSA").

Comparative example 1 employs the aforementioned commercial PAM. Example 3, which is according to the invention, employs the aforementioned "HA-2" having a total nitrogen content of 32.8 wt%. In the comparative and inventive examples the amounts of reactants are adjusted so that in each case the same equivalent amounts of succinic anhydride and primary amine are used, namely 0.1376 equivalents of each.

The results of the sludge prevention tests ("SIB" - sludge inhibition bench test) show that the dispersant of inventive example 3 is more effective than that of comparative example 1 at preventing the formation of (new) sludge in used oil.

Accordingly this evidence shows that the problem as set out in the patent in suit is effectively solved by the claimed measures.

### 3.2 *The closest prior art*

It has not been disputed that D2 can be regarded as the closest state of the art, the disclosure of D1 having been acknowledged by the appellant/opponent as being essentially the same (see section XI(b), above).

D2 relates, like the patent in suit, to additives for lubricating compositions, which additives, according to one embodiment of claim 1 of D2 are produced by

reacting at least one substituted succinic acylating agent with either an amine, an alcohol, a reactive metal or reactive metal compound or a combination of any two of these reactants.

According to D2, col. 1, lines 59 and 60 the additives of D2 are useful especially as dispersant additives, i.e. the same use as set out and exemplified in the patent in suit.

### 3.3 *The objective technical problem with respect to D2*

According to the teachings of D2, one group of suitable amines are branched polyalkylene polyamines. One specifically mentioned compound is that identified as "Polyamine N-400" (D2 col. 25, lines 24-40), which, it is recalled is disclosed as being a single compound having 10 nitrogens, three primary amino groups and an equivalent weight of about 135 grams per equivalent of primary amine (T 39/02 reasons 3.4, referred to in section III(d), above).

Although D2 also discusses mixtures of polyamines, e.g. in column 27, line 22 and in Table I (columns 47-48), as held in part 8 of the reasons of T 39/02 D2 (and indeed D1) is devoid of any disclosure attributing to these mixtures the features specified in operative claim 1.

Thus the operative claims of the patent in suit are directed to a derivative employing a mixture of polyamines whereby the properties of this mixture, specifically the number of nitrogen atoms and equivalent weight per equivalent of primary amine encompass those of the single compound "Polyamine N-400" disclosed in D2.

There is no evidence of a technical effect arising from an additive derived from a **mixture of polyamines** having these properties as compared to an additive derived from a **single compound** exhibiting said properties, i.e. "Polyamine N-400" disclosed in D2.

Accordingly the objective technical problem with respect to D2 must be formulated as the provision of further dispersant additives for lubricating oils, which problem is solved by the use of the defined mixture of higher oligomers of polyalkylene amines.

#### 3.4 *Obviousness*

As explained in T 39/02, part 8 of the reasons insofar as D2 relates to mixtures of polyamines there is no disclosure attributing to these mixtures an average of at least 7 nitrogens per molecule and an equivalent weight of 120-160 grams per equivalent of primary amine as required by operative claim 1.

On the contrary, the disclosure of such mixtures in D2, for instance in Example 10, corresponds to a mixture having a conventional distribution of oligomers, specifically polyamines having from about 3 to 10 nitrogen atoms per molecule. There is no hint to replacing such a mixture with a polyamine mixture having an average of at least 7 nitrogens per molecule, or even how such mixtures could be obtained.

As regards the general disclosure of D2, insofar as it relates to the single chemical compound "Polyamine N-400", there is no suggestion in D2 to replace it with a mixture of polyamines. More importantly, if a modification of "Polyamine N-400" were contemplated

which would result in a mixture of products, there is no reason to assume or expect that the product would be a mixture having an average number of nitrogen atoms per molecule of at least 7. As can be seen from the patent in suit, special measures are necessary to reduce or eliminate the "light bottoms" (cf section 3.1, above), which would otherwise tend to drag down the average number of nitrogen atoms per molecule, starting from a single compound, to below the level required by operative claim 1.

Thus the only basis for the submission of the appellant/opponent (see section XI(b), above) that it would be obvious to replace the single compound "Polyamine N-400" of D2 by a starting mixture of oligomers having, on average a total nitrogen content and an equivalent weight per equivalent of primary amine encompassing those of "Polyamine N-400" is provided by the patent in suit itself.

Accordingly this argument of the appellant/opponent in respect of inventive step relies inadmissibly on knowledge of the invention i.e. is based on hindsight.

- 3.5 A further aspect is that claim 1 is directed to an imidised additive (cf the findings of the decision under appeal with respect to the progress of the acylation reaction reported in the final part of section IV(a), above and the discussion at the oral proceedings before the Board reported in section XI(b), above). In contrast thereto D2 is directed to derivatives of carboxylic acid acylating agents, which according to the disclosure at D2 col. 27, lines 51-55 include *inter alia* amine salts, amides, imides and imidazolines as well as mixtures thereof. It is not

required, or even taught in a general manner in D2 that the reaction of these acylating agents with the polyamines is required to result in an imide or a product which is a mixture containing imides, it being recalled that amines are in any case only one of the types of reactants which may be employed according to D2 (see section 3.2, above).

Accordingly it is not rendered obvious by the disclosure of D2 that the reaction product of the polyamine - when this reactant is selected - and the acylating agent has to be, or even merely contain, imides.

3.6 It is therefore concluded that the subject matter of claim 1 is not derivable in an obvious manner from the closest prior art D2. By analogous reasoning, it is concluded that the subject matter of independent claim 11, directed to a process for producing the imidised additive having the features set out in claim 1, is not obvious.

Since the remaining claims are either dependent on claims 1 or 11 or make reference to the additive of claim 1, this conclusion applies *mutatis mutandis* to the subject matter of claims 2-10 and 12-17.

#### 4. *Other matters- alleged procedural violation*

4.1 In the statement of grounds of appeal the appellant/opponent submitted that the decision under appeal suffered from a substantial procedural violation (see section VI(e), above). Specifically it was submitted that in the discussion of Art. 56 EPC at the oral proceedings the opponent had only been allowed to present comments with respect to D1. The reasons of the

- decision however contained arguments based on D2 and D3 as closest prior art, in respect of which, it was submitted, the opponent had not had the opportunity to comment.
- 4.2 No submissions in respect of this objection were made at the oral proceedings before the Board.
- 4.3 The minutes of the oral proceedings before the opposition division record in section 3 that "Both parties identified D1 as the closest prior art", which statement has not been challenged.
- 4.4 Further it has not been argued before the Board that either party had requested at the oral proceedings before the opposition division to have any other document(s) considered as representing the closest prior art.
- 4.5 Nor was it incumbent on the opposition division to solicit or invite any such further arguments. On the contrary, doing so would not be consistent with the need for procedural economy.
- 4.6 The fact that the opposition division chose, *ex officio*, in the written reasons to consider arguments, i.e. those based on D2 and D3, which had been presented in the written procedure, but on which neither party had sought to make further submissions during the oral proceedings does not constitute an infringement of the right to be heard.  
Accordingly the Board is satisfied that no procedural violation, let alone a substantial procedural violation, occurred.

**Order**

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:

The Chairman:

E. Goergmaier

R. Young